Chapter Three: Habitat, Fish and Wildlife

Contents

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A. Habitats

Habitats which support natural resources of the sale area include the coastal zone, arctic plain, and northern foothills of the Brook Range. Freshwater streams and lakes, aquatic plants, wetlands, tussock meadows, and riverine corridors provide species higher up in the food chain with essential nutrition and shelter. Important fish and wildlife species which depend on habitats of the Sale 87 area are described in section B of this Chapter.

1. Coastal Zone

Nearly half of the Sale 87 area is located within the coastal zone where activities are subject to the North Slope Borough Coastal Management Program (DGC, 1985). The boundary of the coastal zone extends inland approximately 25 miles (DGC, 1985). To protect fish spawning and overwintering habitats, the coastal zone also includes certain river corridors, including the Colville, Miluveach, Itkillik, Anaktuvuk, Chandler, Sagavanirktok, Shaviovik, Kavik, and Canning (NSBCMP 1984b)

Along the Beaufort coast, adjacent to the Sale 87 boundary, salt water dependent habitats merge into freshwater habitats. Saltwater intrudes in soils and ground water flows. Coastal vegetation is influenced by sea spray; on average as far as two to three miles inland. Stream slope and freezing action in winter generally determine the distance at which saltwater reaches upstream (DGC, 1985).

The coastal zone supports optimum waterfowl and shorebird nesting habitat, caribou calving and feeding grounds, and polar bear denning sites. The coastal zone is indirectly influenced by activities outside of the sale area. For example, caribou wintering in the Brooks Range are influenced by the availability of food in their preferred summering habitat on the Arctic coastal plain (DGC, 1985). The coastal zone provides important spawning habitat for marine fish and invertebrates. These creatures in turn provide waterfowl and marine birds with a plentiful source of food (DGC, 1985). All rivers flowing into the Beaufort Sea, and the inland extent of anadromous fish populations host species that are indirectly influenced by the coastal zone. At a minimum, the coastal zone includes the extent of coastal wet tundra habitat; a range roughly corresponding to the 200 foot contour (DGC, 1985).

The tundra surface is marked by lakes, thaw ponds, frost cracks, and polygonal ground formations. Successive freezing and thawing of moisture laden soils causes frequent draining and reforming of lakes and surface peat. The soil beneath tundra freezes each winter, thaws in spring, and is saturated with salt or fresh water throughout the summer. The freeze-thaw process causes these lakes to reform each year. Tundra and grasses of the barrier islands are also exposed to freeze-thaw processes (AEIDC, 1975:36).

The vegetation habitats of the Sale 87 area can be roughly divided into two ecoregions; the Arctic plain and the Arctic foothills. Additionally, across the North Slope and throughout the sale area, wetland habitats and their characterization are of key interest to scientists, ecologists, government, and industry.

2. Arctic Plain

The distribution of vegetation types on the Arctic plain is strongly associated with microtopographic features which affect soil drainage. Wet soil conditions support wet graminoid herbaceous communities dominated by sedges or grasses. Dwarf scrub communities grow where soil conditions are dryer, such as at thaw lake margins, along river bluffs, or other more elevated areas which provide a rooting zone above the standing water table (USGS, 1995).

Most sedge communities are dominated by *Carex aquatalis* and *Eriophorum angustifolium* (narrow-leaf cottongrass). Mosses (usually *Scorpidium spp*. or *Drepanocladus spp*.) may be common (USGS, 1995). Grass communities on the Arctic plain are dominated by *Dupontia fischeri* and *Alopecurus alpinus* (mountain foxtail), however *Arctophila fulva* (pendent grass) dominates in surface waters of 15 to 200 cm in depth. Dwarf scrub communities include *Dryas integrifolia*, *Vaccinium vitis-idaea*, *Cassiope tetragona*,

Arctostaphylos alpina, *Arctostaphylos ruba*, *Salix reticulata*, and *Salix phlebophylla* (USGS, 1995). Secondary species include common names of lousewort, and buttercup in the wetter sites, and heather and purple mountain saxifrage in the raised drier habitats (AEIDC, 1975:122).

3. Northern Foothills

The distribution of vegetation in the northern foothills of the sale area is also affected by soil conditions, elevation, and drainage. Major streams flowing from the Brooks Range are controlled by bedrock. Plant communities in lakes form concentric bands that correspond with water depth. Lakes deeper than 1.5 m do not usually support aquatic plant life (USGS, 1995).

Plant communities are commonly dominated by mesic graminoid herbs and dwarf scrub. Mesic graminoid herbaceous communities are commonly dominated by tussock-forming sedges, and include *Eriophorum vaginatum* and *Carex bigelowii*. Low shrubs, such as *Betula nana* (Dwarf arctic birch), *Empetrum nigrum* (crowberry), *Ledum decumbens* (Labrador tea), and *Vaccinium vitis-idaea* (mountain cranberry) may also dominate plant communities along with sedges. Mosses and lichens are common between tussocks (USGS, 1995).

Dwarf scrub communities are dominated by *Dryas spp*., ericaceous species, and (*Salix reticulata* and *Salix phlebophylla* (prostrate willows). Low scrub communities are dominated by *Alnus crispa* (alder), and *Salix lanata*, *Salix planifolia*, and *Salix glauca*. Mosses are commonly abundant (USGS, 1995). These plant communities provide an important source of nutrition for caribou as they forage on their summer range.

Waterbirds depend on or prefer certain habitat types, and attempts have been made to rank the value of these habitats, especially on the Colville River. Large ungulates (caribou, muskoxen) are equally dependent on vegetation habitats of the North Slope. Most of the oilfield areas are considered wetlands.

4. Wetlands

Wetlands are lands where saturation with water is the dominant factor in determining the nature of soils and the types of plant and animal communities living in the soil and on the surface. Wetlands occur where the water table is at or near the surface, the land supports at least periodically water-loving plants (hydro-phytes), and the substrate or surface is saturated with water or covered by water at some time during the growing season each year (Cowardin, et al., 1979:3).

Concern over wetland loss from gravel infilling associated with oil and gas development and its effects on calving, migration, nesting, and brood rearing, drives classification studies. Bergman et al. (1977) identified eight wetland designations related to birds (See Table 3.1)

Table 3.1 Wetland Designations

Class Designation	Cover type
Class I. Wetland Tundra	Wet sedge meadow, sedge, willow
Class II. Shallow-Carex	Wet sedge meadow, sedge, willow
Class III. Shallow-Arctophila	Wet grass-sedge meadow
Class IV. Deep-Arctophila	Wet grass-sedge meadow, Discrete lake
Class V. Deep-open	Discrete lake, Tapped lake
Class VI. Basin-complex	Wet sedge meadow
Class VII. Beaded streams	Barren
Class VIII. Coastal wetlands	Midgrass-herb, halophytic sedge, halophytic grass-sedge, halophytic herb

From Meehan & Jennings, 1988.

Meehan and Jennings (1988) studied the distribution and behavior of birds on the Colville Delta, and derived nine habitat classes for large waterbirds (Tundra swan, Greater white-fronted goose, Pacific loon, Yellow-billed loon, and brant):

- Discrete Lake habitat includes lakes and estuarine waterbodies, similar to Bergman's Class V.

- Tapped Lake habitat includes lakes that are hydrologically connected to a river system. In spring, flooded channels breach these lakes, allowing sediments and salt water to infiltrate. This class is also similar to Bergman's Class V.
- Wet-Moist Flooded Tundra includes wet sedge polygonal ground (Bergman's Class I) and moist sedge willow (Bergman's Class II).
- Wet Graminoid habitat is found along lake shores and polygonal ponds. Similar to Bergman Classes III and IV, the largest stands on the Colville Delta are located in its south central portion (located within the Sale 87 area). This habitat includes dominant species, *Arctophila fulva* and *Carex aquatalis*.
- Wet-Moist Polygons include moist to wet low tundra meadows; near lake ponds and margins, flooded basins, and polygonal ground. Similar to Bergman Classes I and II, this habitat is the most abundant vegetation cover on the Colville Delta. This vegetation type was used by Pacific and Yellow-billed loon nesting and Tundra swan and white fronted geese.
- Brackish Flats, similar to Bergman's Class VIII, are found along the fringe of the delta, river channels, and tapped lakes. This habitat type has been associated with high brant use.
- Shrub Dominant Areas consist of low willow communities on river banks, terraces and dunes. Most bird use was low, and there was no equivalent Bergman class.
- Barrens includes partially vegetated dunes, grass-forb lake shore, and partially vegetated and unvegetated floodplain. Similar to Bergman's Class VIII, this habitat is of low use by most birds and covers about 30 percent of the Colville Delta's total area.
- Sedge-Tussock Tundra, found in the western part of the delta, has no comparable Bergman class.

Meehan and Jennings (1988) ranked the importance of habitat classes relative to usage by key bird species. Discrete lakes were used the most, followed by Wet-Moist Polygons, Brackish Flats, Wet Graminoid, and Wet-Moist Flooded Tundra. Tapped Lakes and Shrub Dominant Areas received an equal amount of use after the top six, followed by Sedge-Tussock Tundra and Barrens which were used the least. The authors caution that although the classes may apply to habitats across the North Slope, the ranking should only be applied to the Colville River Delta.

In a remote sensing study of Snow goose brood-rearing habitat on the Sagavanirktok River delta, Burgess and Ritchie (1988) followed the classification scheme of Walker and Weber (1980) to derive a similar habitat classification (See Table 3.2)

Table 3.2 Snow goose brood-rearing habitat classification

Plant Community	Description	Dominant plant species
Moist Graminoid	moist upland sites, dry low-centered polygons and polygon rims	*Carex aquatalis, Dryas integrifolia, Salix arctica*
Wet Graminoid	wet areas in sand dune regions	*Carex aquatalis, Dupontia fischeri, Salix ovalifolia*
Wet Coastal Saline Graminoid	coastal estuaries and lagoon area normally flooded with salt water part of the year	*Carex subspathacea, Dupontia fischeri, Eriophorum angustifolium*
Very Wet Graminoid	pond and lake margins	*Carex aquatalis, Arctophila fulva*
Dry Coastal Bluff Barrens	coastal bluffs and ridges	*Dryas integrifolia, Sedum rosea*

From: Pollard, et al, 1992:4

More complex vegetation classification systems have been developed for oil and gas development proposals; some are species specific and some focus on terrain types. Field surveys are expensive, and increased complexity in project proposal documents provides agencies with more information to make permitting decisions. For example, in the Alpine Development Project, habitats on the Colville Delta are described with 24 habitat types; a system developed by Viereck, et al. 1992) and modeled after Cowardin, et al. (1979).

For the purposes of carrying out the provisions of Section 404 of the Clean Water Act, Cowardin, et al.(1979) developed a wetlands classification system for the USF&WS. Subsequently, a manual was developed for use by USACE field inspectors who make wetland determinations (USACE, 1987:7). Since

1979, numerous classification systems have been developed for wetland habitat characterization. Today, the USACE may use many classification systems in making wetland determinations. The more information and detail on site-specific characteristics, the better USACE is able make wetland determinations (Carpenter, 1997).

Regardless of the habitat class system used in planning, the important points to consider are which plant species are associated with various life stages of important animals (feeding, nesting, incubation, brood rearing, etc.), and what is the most appropriate and practical way to identify those terrainís and important species. For caribou, some plant species may provide greater nutritional value for migrating, gestating, and new born animals. Since nearly all of the North Slope is wetland habitat, uplands are rare and may become more valuable to species like caribou, especially during the insect season. Non-wetland habitats include pingos, high-top polygons, steep river banks, gravel bars, and dunes (Carpenter, 1997). The following section discusses the sale area's fish and wildlife with references to key supporting habitats.

B. Fish and Wildlife Species, and Their Habitats

1. Fish

Fish species likely to be found in or near Sale 87 area waters are listed in Table 3.3. Important fishery resources are found within the sale area. Anadromous Dolly Varden spawn and overwinter in discrete and isolated sections of the Kavik, Canning, and Shaviovik rivers (Ott, 1996). A number of other streams in the sale area appear to contain suitable habitat for anadromous fish but have not been surveyed. A variety of freshwater fish species are present including Arctic Grayling, lake trout, northern pike, burbot, and several species of whitefish (Ott, 1995). Arctic char occur in the Sagavanirktok and Colville drainages but are not known to be anadromous in these systems. Dolly Varden also occur in both of these drainage, and include both anadromous and stream-resident forms (Ott, 1997).

The Colville River supports an abundance of fish, composed of at least twenty species, the dominant species being whitefishes and ciscos. Other species found in the Colville River include chinook, chum, and pink salmon, Dolly Varden char, and Arctic grayling. Like other North Slope rivers, the Colville River discharges warmer freshwater into the Beaufort Sea, forming a zone of warmer brackish water along the coast. This zone of brackish water is an important factor affecting the distribution and abundance of all Beaufort Sea fish because of its importance to anadromous fish for feeding and migrating. Freshwater fish species are found in lakes and the Colville River. These species include arctic grayling, round whitefish, non-migratory arctic char, burbot, ninespine stickleback, slimy sculpin, and lake trout (See Figure 3.1).

Nearshore waters and lagoon systems provide migration corridors and important feeding habitat for these anadromous fishes (USDOI, 1987). The warmer nearshore waters contain an abundance of amphipods, isopods, euphausids, coelenterates, and chaetognaths (Gertler, 1988) which provide important food sources for anadromous fish in marine waters.

Anadromous fish typically leave the rivers and enter the nearshore waters of the Beaufort Sea during spring break-up, from mid-to late June. They initially occupy open water leads nearshore before dispersing along the coast to feed as the ice cover melts and recedes. Small fish tend to remain near overwintering rivers such as the Colville, while larger fish may migrate distances of 80 miles or more in search of feeding habitat. Migration back to rivers varies by species, but most anadromous fish return to freshwater, where they spawn, by mid-September (ADNR 1991a:13).

As with most anadromous fish species, whitefish spend much of their life cycle in salt water. They feed in salt water during the summer, but unlike other anadromous fish, generally remain in freshwater plumes extending out from river mouths and in marine waters of lower salinity. As with arctic char, these species move up river around mid-August and spawn in late September or October (Roguski and Komarek, 1971).

Table 3.3 Important Anadromous Fish Streams Located in Sale 87

Stream Name	Dolly Varden	Whitefish	Pink Salmon	Chum Salmon
Anaktuvuk River	X			
Canning River	X	X	X	X
Chandler River	X	X		
Colville River	X	X	X	X
Colville River Delta	X	X	X	X
East Badami Creek	X			
East Creek		X		
East Sagavanirktok Creek	X			
Echooka River	X			
Itkillik River	X	X	X	X
Ivishak River	X			X
Kadleroshilik River	X			
Kalubik Creek	X			
Kavik River	X			
Kuparuk River		X		
Little Putuligayuk River		X		
No Name River	X			
Putuligayuk River	X	X		
Sagavanirlktok River	X	X	X	X
Sakonowyak River		X		
Shaviovik River	X			
Staines River	X	X	X	
Ugnuravik River		X		
Unnamed Lake, west of West Dock	X			
West Fork Kalubik Creek	X	X		

Source: Ott, 1997

Least cisco and arctic cisco are among the most abundant anadromous fish captured in the Prudhoe Bay and Sagavanirktok Delta areas. They inhabit the nearshore environment and spawn in the fall. The Colville River is a major overwintering area for cisco. During the ice-free period cisco undertake extensive migrations through the nearshore area (NSBCMP, 1984a:1-194). Cisco of the Colville River migrate from natal streams and tributaries of the Mackenzie River Delta system in Canada. Newly hatched Arctic cisco from Canada move westward into the Alaska Beaufort sea during late July to early August, especially in years with a prevalence of easterly winds. Thus, these fish must pass through the area of coastal development associated with Prudhoe Bay and Kuparuk oilfields. Arctic cisco of the Colville River delta spend most of the summer feeding in nearshore coastal waters, and then return to the river's channels and lakes in September and October to overwinter (Fechhelm and Griffiths, 1990).

Non-anadromous fish inhabit freshwater year-round. Virtually all Arctic grayling are found exclusively in freshwater throughout the year (Ott, 1997). Dolly varden, and broad and humpback whitefish remain in freshwater for several months or years, depending on the species, before migrating to coastal waters, returning to inland waters to spawn and overwinter (ADNR, 1990:25). A lack of overwintering habitat is the primary factor limiting arctic fish populations. Rivers freeze to the bottom over much of their length, therefore only the deeper sections are available for overwintering habitat (Sousa, 1992:2). The Colville River provides the most consistently available overwintering habitat (Baker 1987:1-8).

Figure 3.1 Important Anadromous Fish Habitat

2. Birds

Major concentrations of birds occur in and near portions of the Sale 87 area (See Figure 3.2 and Table 3.4). The Colville River, Fish Creek, Sagavanirktok River, Kuparuk River, and Canning River deltas, and Simpson Lagoon, are very important nesting and breeding areas for waterfowl (MMS, 1996a: III-B-6). Different species of birds are found among the several habitat types of the Sale 87 area.

The Colville, Sagavanirktok and Kuparuk river deltas provide important breeding and brood-rearing habitats for tundra swans, black brant, snow geese, and Canada geese. Howe Island, located in the Sagavanirktok River Delta, is the location of one of two known snow goose nesting colonies in the United States (Sousa, 1992). According to ADF&G, three colonies have been identified in Alaska: one in NPR-A in the Ikpikpuk River delta (50 nests), one in Kaseleguk Lagoon at the Kukpowruk River delta adjacent to the Chukchi Sea coast (50 nests), and one on Howe Island. In 1990, 380 to 450 snow goose nests were counted on Howe Island. In the past, the colony has been decimated by fox predation, however, the island is isolated by discharge from the Sagavanirktok River early in spring, generally preventing foxes from reaching the island in most years (Winters, 1997). This island also is important for black brant nesting (Sousa, 1992:3). The Return Islands, Jones Islands, McLure Islands, Cross Island, and Lion Point are important for nesting common eider. Thousands of oldsquaws concentrate near Flaxman Island to molt (Bright, 1992). Greater-white fronted geese are also found nesting and rearing in the major river deltas and other coastal plain areas (Ott, 1997:2).

The most abundant marine and coastal species include: red phalarope, oldsquaw, glaucous gull, and common eider. Nearly all of these species are migratory and are found in the Arctic seasonally, generally from May through September. Shortly after spring migration, most shorebird and waterfowl populations disperse to nesting grounds primarily on tundra and marshlands of the arctic slope. Beginning in late June, large concentrations of oldsquaw and eider occur in coastal waters inshore of islands where the birds feed and molt before fall migration. Use of lagoons and other coastal habitats peaks in August to late September before and during the fall migration (MMS 1996a:III-B-6).

Figure 3.2 Important Bird Habitat

Table 3.4 Birds Commonly Observed in the Vicinity of Sale 87 and their Commonly Used Habitats.

Common Name	Scientific Name	Offshore Areas	Barrier Islands/ Lagoons	Estuary	Wetlands Tideflat	Rivers, Lakes, Streams	Uplands
Yellow-billed loon	*Gavia adamsii*	X	X	X	X	X	
Pacific loon	*Gavia arctica*	X	X	X	X	X	
Red-throated loon	*Gavia stellata*	X	X	X	X	X	
Tundra swan	*Olor columbianus*			X	X	X	X
White-fronted goose	*Anser alibifrons*			X	X	X	X
Snow goose	*Chen caerulescens*			X	X	X	X
Canada goose	*Branta canadensis*			X	X	X	X
Black brant	*Branta bernicla*		X	X	X	X	X
Mallard	*Anas platyrhynchos*				X	X	X
Pintail	*Anas acuta*				X	X	X
Green-winged teal	*Anas crecca carolinensis*				X	X	X
American wigeon	*Anas americana*				X	X	X
Northern shoveler	*Anas clypeata*				X	X	X
Greater scaup	*Aythya marila*				X	X	X
Lesser scaup	*Aythya affinis*				X	X	X
Common eider	*Somateria mollissima*	X	X	X	X	X	
King eider	*Somateria spectabilis*	X	X	X	X	X	
Steller's eider	*Polysticta stelleri*	X	X	X	X	X	
Spectacled eider	*Somateria fischeri*	X	X	X	X	X	
Oldsquaw	*Clangula hyemalis*	X	X	X	X	X	
Surf scoter	*Melanitta perspicillata*	X	X	X	X	X	
White-winged scoter	*Melanitta deglandi*	X	X	X	X	X	
Red-breasted merganser	*Merqus serrator*			X	X	X	
Rough-legged hawk	*Buteo lagopus*			X	X		
Harrier	*Circus cyaneus*				X		X
Golden eagle	*Aquila chrysaetos*				X		X
Gyrfalcon	*Falco rusticolus*				X		X
Peregrine falcon	*Falco peregrinus*				X		X
Willow ptarmigan	*Lagopus lagopus*						X
Rock ptarmigan	*Lagopus mutus*						X
Semipalmated plover	*Charadrius semipalmatus*		X		X	X	X
American golden plover	*Pluvialis dominica*		X		X	X	X
Killdeer	*Charadrius vocifeurs*		X		X	X	X
Black-bellied plover	*Pluvialis squatarola*		X		X	X	X
Bar-tailed godwit	*Limosa lapponica*				X	X	X
Buff-breasted sandpiper	*Tryngites subruficollis*		X		X	X	X
Long-billed dowitcher	*Limnodromus scolopaceus*				X	X	X
Ruddy turnstone	*Arenaria interpress*		X		X	X	X
Common snipe	*Capella gallinagp*		X		X	X	X
Whimbrel	*Numenius phaeopus*		X		X	X	X
Spotted sandpiper	*Actitis macularia*		X		X	X	X
Pectoral sandpiper	*Calidris melanotos*		X		X	X	X
Rufus-necked sandpiper	*Calidris ruficollis*	X		X	X	X	
White-rumped	*Calidris fuscicollis*		X		X	X	X

Common Name	Scientific Name	Offshore Areas	Barrier Islands/ Lagoons	Estuary	Wetlands Tideflat	Rivers, Lakes, Streams	Uplands
sandpiper							
Dunlin	*Calidris alpina*		X		X	X	X
Baird's sandpiper	*Calidris bairdii*		X		X	X	X
Sanderling	*Calidris alba*		X		X	X	X
Semipalmated sandpiper	Calidris pusilla	X		X	X	X	
Red phalarope	*Phalaropus fulicaria*	X	X	X	X	X	X
Northern phalarope	*Phalaropus lobatus*	X	X	X	X	X	X
Parasitic jaeger	*Stercorarius parasiticus*	X	X		X		X
Pomarine jaeger	*Stercorarius pomarinus*	X	X		X		X
Long-tailed jaeger	*Stercorarius longicaudus*	X	X		X		X
Glaucous gull	*Larus hyperboreus*	X	X	X	X	X	X
Thayer's gull	*Larus thayeri*	X	X	X	X	X	X
Herring gull	Larus argentatus	X	X	X	X	X	X
Mew gull	*Larus canus*	X	X	X	X	X	X
Black-legged kittiwake	*Rissa tridactyla*	X					
Sabine's gull	*Xema sabini*	X	X	X	X	X	X
Arctic tern	*Sterna paradisea*	X	X	X	X	X	X
Thick-billed murre	*Uria lomvia*	X					
Black guillemot	*Cepphus grylle*	X	X				
Short-eared owl	*Asio flammeus*				X		X
Snowy owl	*Nyctea scandiaca*				X		X
Horned lark	*Eremophila alpestris*				X		X
Common raven	*Corvus corax*				X		X
Black-billed magpie	*Pica pica*				X		X
Robin	*Turdus migratorius*				X		X
Grey-cheeked thrush	*Catharus minmus*				X		X
Northern shrike	*Lanius exubitor*				X		X
Wheatear	*Oenanthe oenanthe*				X		X
Bluethroat	*Luscinia avacica*				X		X
Arctic warbler	*Phylloscopus borealis*				X		X
Yellow wagtail	*Motacilla flava*				X		X
Water pipit	*Anthus spinoletta*			X	X		
Wilson's warbler	*Wilsonia pusilla*				X		X
Hoary redpoll	*Carduelis hornemanni*				X		X
Common redpoll	*Carduelis flammea*					X	X
Savannah sparrow	*Passerculus sandwichensis*					X	X
Tree sparrow	*Spizella arborea*						X
White-crowned sparrow	*Zonotrichia leucophrys*					X	X
Fox sparrow	*Passerella iliaca*					X	X
Dark-eyed junco	*Junco hyemalis*					X	X
Lapland longspur	*Calcarius lapponicus*					X	X
Snow bunting	*Plectrophenax nivalis*					X	X

Source: Ott,1992:4. ADNR, 1990:21.

Oldsquaw is probably the most common species of waterfowl that nests in the Beaufort Sea area. Male Oldsquaw begin moving in late June to protected coastal areas in lagoons and large lakes for molting (Ott, 1997). Their nests consist of small, cup-like hollows. Oldsquaw clutches of 9 to 12 eggs are common, but most number 5 to 10 eggs. In the Beaufort Sea area most eggs hatch from July 16 to July 28. Female Oldsquaws lead their young to the nearest water shortly after the young have hatched and dried. Male Oldsquaw begin moving in late June to protected coastal areas in lagoons and large lakes and form massive

molting flocks (Ott, 1997). Fall migration begins in late September or early October (Johnson and Herter, 1989:95).

The Red Phalarope is a common migrant and breeder throughout the Beaufort Sea. They appear in the Sale 87 area in late May or early June. Nesting takes place in hummocky, moss-seged tundra interspersed with numerous ponds. Females usually lay four eggs, however if breeding is delayed, clutch size is reduced. Males incubate the eggs and care for the young until shortly before they are fledged. The fledging period is 16 to 18 days. The male then abandons the young and departs the breeding area. Adult migration commences from early June to mid-August. The young depart the nesting areas from mid-August to early September (Johnson and Herter, 1989:184).

The Glaucous Gull is a common migrant and breeder in the Beaufort Sea area. They usually arrive in the Sale 87 area during May. Glaucous Gulls select several types of nesting sites depending on availability. Pairs either nest on low islands and sandbars near or on the coast or on inland river bars or small islands in lakes. They are most common on barrier islands immediately offshore from rivers that flood in the spring and thereby protect the nests from foxes. On level terrain, nests may be as much as a meter high and are composed of vegetation. Occasionally, nests consist of a simple depression in the beach and have little or no lining material. Egg laying begins in mid-June and continues through late June. The normal clutch size is 3 eggs and hatching begins in the second week of July. Chicks are attended by both parents until they fledge in about 45 to 50 days. During the breeding season these gulls prey heavily on the eggs and chicks of other birds. Fall migration begins in mid-September. The young remain somewhat later than most adults (Johnson and Herter, 1989:203).

The Common Eider is an abundant species in the Beaufort Sea area. It is sometimes called the Pacific Eider and arrives in the Sale 87 area from late May to early June. They most commonly nest on barrier islands and spits from mid to late June. Clutch sizes range from 1 to 10 eggs but usually number 4. Nests are usually placed in well protected areas near logs, in driftwood, between rocks or in thick vegetation. Young are usually led directly to water soon after they hatch. Fledging occurs from 6 to 12.5 weeks after hatching. Males then leave their nesting areas for molting areas in the vicinities of Point Lay, Icy Cape, and Cape Lisburne in western Alaska. Females and their young begin the fall migration in late August or early September (Johnson and Herter, 1989:73).

Tundra swans are common breeders on the coastal plain of the North Slope. The Colville River Delta supports densities of breeding Tundra Swans that are three to five times greater than other arctic areas of Alaska. Tundra Swans begin nesting during the last week of May and the first two weeks of June. Nests are large (approximately 1 m high and up to 2 m in diameter) and widely scattered. The nests are generally located on sedge tundra. After hatching in late June or early July, broods are reared in nesting territory (Smith et. al. 1993:12). Adults molt from mid-July through August. Fall migration occurs from late September to early October. They winter along the east and west coasts of North America, from the Aleutian Islands to California and from Maryland to North Carolina (Johnson and Herter, 1989:17).

Black brant are a common migrant and breeding bird along the Beaufort Sea coast. Black brant nest on islands in the Colville River and the Sagavanirktok River deltas. Nesting takes place in June. Black brant normally lay four to eight eggs. Black brant do not re-nest if their first attempt at nesting fails. The newly hatched geese leave the nest within 48 hours and they move to nearby tidal flats where they spend the brood-rearing period. Brood-rearing ends and the fall migration begins around the second week of August. Some brant remain in the Beaufort Sea area until late September or early October (Johnson and Herter, 1989:47).

Arctic peregrine falcons nest south of the sale area primarily on bluffs along the Colville River from Umiat to Ocean Point, and at Franklin and Sagwon Bluffs in the Sagavanirktok River drainage. Additional nest sites may occur at other locations. Arctic peregrine falcons are present on the North Slope from late April through September. Nesting begins by mid May, and the young birds fledge from late July to late August. Immature peregrine falcons from the Colville to the Sagavanirktok River drainages move toward the Beaufort Sea coast in mid-to late August. Peregrine falcons generally have left the North Slope by late September (Ott, 1997).

Snow geese arrive in the Sagavanirktok River delta during the last week of May and occupy nesting habitat on Howe Island in the first days of June. Most adult females arriving on the breeding grounds have already paired and copulated and have well-developed eggs in their oviducts. They lay their eggs within four

days to a week after they arrive. They build their nests of grass and bits of willow on high ground. Clutch size is three to six eggs which usually hatch during the last week of June or the first week of July. Snow goose goslings require about seven weeks to fledge. They leave the brood-rearing areas by approximately August 15 to August 20 and congregate in immense flocks on the coastal tundra to feed almost continuously. Snow geese and black brant from the Howe Island colonies often move to the Kadleroshilik River Delta to rear in the salt marshes (Ott, 1992). Half of the snow geese from the Howe Island colony take their broods to the Kadleroshilik River salt marshes for the months of July and August (Sousa, 1992:3). Fall migration begins in the second or third week of September (Johnson and Herter, 1989:29).

The historic breeding range of the spectacled eider includes the coastal tundra areas of the North Slope from Barrow to the U.S.- Canadian border (Sousa, 1992). The spectacled eider was listed as threatened under the Endangered Species Act in May 1993. Probably less is known of the spectacled eider than of any other North American migratory waterfowl species. Spectacled eiders occur throughout the lease sale area. All of the onshore tracts are within the expected breeding range for this species (Sousa, 1997).

Important habitats for arctic-breeding Spectacled Eiders include large river deltas, tundra rich in lakes, and wet, polygonized coastal plains with numerous waterbodies (USDOI, 1996:24). Females lay one egg per day and begin incubation with the laying of the last egg. Clutch size averages between 3.8 and 4.5 eggs. Hatching occurs from mid-to late July. Fledging occurs approximately 50 days after hatching. Females and their broods then move directly from freshwater to marine habitats (USDOI, 1996:20). During August, productive adults undertake their summer molt. Fall migration from the Beaufort Sea by males may begin in mid-summer. Most Spectacled Eiders have left the coast by September 20 (Johnson and Herter, 1989:87).

The Steller's Eider is an uncommon breeder along the Beaufort Sea Coast. Little is known about the breeding biology of the Steller's Eider but they are thought to nest near the coast only where deep water is present offshore. In the Barrow region, they nest on tundra along the shores of lakes, ponds and lagoons. The nest is a deep cup in the tundra. It consists of curly, coarse grasses and various mosses and lichens and is well lined with down and feathers. Females lay between six to ten eggs and incubate them for about three weeks. Hatching along the Beaufort Sea apparently begins during the first or second week of July. Most young are probably ready to fly by August. Steller's Eiders migrate from the Beaufort Sea during late September and early October (Johnson and Herter, 1989:91). They were listed as threatened under the Endangered Species Act on June 11, 1997.

Canada Geese arrive along the arctic coast during the last two weeks of May and the first week of June. They nest primarily away from the sea coast, on bluffs along the Colville River. However, some isolated pairs have been found nesting in moderate densities in coastal wetlands near Prudhoe Bay. They usually lay their eggs during the first or second week of June. The clutch size may vary from 1 to 10 eggs which hatch within the first two weeks of July. After the goslings have fledged in mid-August, flocks begin dispersing along the Beaufort Sea and begin their southward migration.

The Greater white-fronted goose is a common breeding bird along the Beaufort Sea coast. They reach the Beaufort Sea breeding areas from the second week of May to the first week of June. The female usually selects a nest site on well-vegetated (scrub willow tundra) and well-elevated habitat near a lake or river. Eggs are laid during the last half of May or the first two weeks of June. The female lays her eggs in a slight depression and builds the nest as she completes her clutch of 4 to 7 eggs. The incubation period varies from 23 to 28 days. Breeding adults usually molt when goslings are two to three weeks old. Fall migration may begin as early as August 10 with the last Greater White-fronted Geese leaving Alaska by the end of September (Johnson and Herter, 1989:23).

The Colville River Delta supports some of the highest densities of breeding Yellow-billed loons in Alaska (Smith et al 1993:i). Yellow-billed loons arrive in the Sale 87 area in late May. They concentrate during spring with other species of loons in early-melting areas off the deltas of the Sagavanirktok, Kuparuk, and Colville Rivers. Yellow-billed loons prefer gently sloping shores of deep tundra lakes as nest sites. The nest is usually a built-up mound of turf and mud on the shoreline of a lake or occasionally on the shoreline of a large river. Egg laying begins as early as the second week of June and hatching takes place in July and early August. The normal clutch size is two eggs. The age at which Yellow-billed loons fledge has not been recorded precisely but may be similar to Common Loon chicks which is 45 days. The peak fall migration for Yellow-billed loons is in late August or early September (Sousa, 1995:2; Johnson and Herter, 1989:9).

3. Terrestrial Mammals

a. Caribou

Caribou (*Rangifer tarandus*) are members of the deer family. Four caribou herds use the coastal habitats within and adjacent to the Sale 87 area. A herd is a group of caribou which establishes a calving area distinct from any other group and calves there repeatedly (ADF&G, 1994). The Western Arctic Herd (WAH) ranges over an area that extends approximately from the Colville River to the western coast of Alaska (See Figure 3.3). The Porcupine Caribou Herd (PCH) ranges adjacent to the sale area, south from the Beaufort Sea coast, from the Canning River eastward into Canada. The range of the Central Arctic Herd (CAH) extends from the northern foothills of the Brooks Range to the Beaufort Sea and from the Colville River east to the Canning River. A fourth herd, the Teshekpuk Lake Herd (TLH) occupies the area around Teshekpuk Lake, west of the Sale 87 area. TLH caribou have been observed in the Colville River Delta seeking relief from insect harassment (Smith et al, 1993:46.) See Figure 3.3 showing caribou distribution.

Caribou normally move toward the coast to calve and escape the predators of their winter range. The WAH's major calving area is inland on the NPRA. The PCH calving range is along the Beaufort Sea coast from the Canning River to the Babbage River in Canada. The location of calving areas has changed over time. The CAH calving area has been described as the area between the Eastern Channel of the Colville River and Kalubuk Creek (Smith et al., 1994, 9; citing to Lawhead and Cameron, 1988). Current primary calving concentration areas lie between the Sagavanirktok and Canning Rivers in the area south of Bullen Point, and to the southwest of the Kuparuk oilfield (Ott, 1997). Lesser used calving areas have also been identified in the area between the Eastern Channel and the Nechelik Channel of the Colville (Smith, et al. 1994, 9; citing to Whitten and Cameron, 1985) and in the foothills of the Brooks Range, south of the Colville River delta. Use of calving habitat varies with weather and snow conditions. The fidelity of caribou to their calving area suggests that certain areas, such as those mentioned above, may be more important than other seasonal ranges.

In late May or early June a single calf is born (twins are very rare) mostly within 30 miles of the coast. Coastal areas seem to be preferred calving habitats, but calving occurs further inland as well (Baker 1987:1-3). Newborn calves can walk within an hour of birth. After a few days, they can outrun a man and swim across lakes and rivers. Newborn calves weigh an average of 13 pounds and may double their weight in 10-15 days (ADF&G, 1994).

Caribou summer on the arctic coastal plain. The CAH spends June through mid-August near the Arctic coast between the Colville and Canning Rivers (Whitten, 1995). In midsummer, from mid-to late June through July, caribou are often harassed by hordes of mosquitoes, warble flies, and nose flies. Movement during the summer is closely tied to insect harassment. In response, caribou move from inland feeding areas to windswept, vegetation-free coastal areas where the insects are limited. Sometimes the animals will run in a frenzy for long distances, stopping to rest only when exhausted or when wind offers relief from the insects (ADF&G, 1994). Most insect relief areas are found within two miles of the coast (ADF&G 1986b:71), however, caribou also tend to congregate on gravel drilling pads and roads which are generally raised above the tundra and more exposed to the elements (USACE 1984:141). Caribou that remain inland may move to river bars and bluffs to escape these insects. The frequency and duration of caribou movements to and from the coast depend on weather related changes that affect the number of mosquitoes. Caribou distribution on the coastal plain can change dramatically within a 24-hour period.

The fall migration south begins in September and ends by mid-November. During both the spring and fall migrations, the herd tends to move along or near major river drainages, such as the Itkillik, Kuparuk, Shaviovik, and Canning. Caribou generally winter in the northern foothills of the Brooks Range. Occasionally, some remain on the coastal plain during mild winters. (Ott, 1992).

Figure 3.3 Important Wildlife Habitat

Caribou must keep moving to find adequate food. This distributes feeding pressure and tends to prevent overgrazing. Caribou are great wanderers and very efficient at moving across both boggy and rugged terrain. They commonly travel vast distances to reach suitable foraging sites on widely separated season ranges. Feeding opportunities are limited in windswept insect relief areas, so caribou move inland to better foraging areas whenever insect harassment temporarily subsides, and return to the coast when harassment increases. In summer, caribou eat a wide variety of plants, apparently favoring the leaves of willows, grasses, and herbaceous and flowering plants. During winter, they use windswept upland areas, or areas of lighter snow cover where they can dig through the snow to feed on lichens, "reindeer moss," and dried sedges (ADF&G, 1994).

Historic population counts for all four herd populations are depicted in Table 3.5. Caribou calf survival and adult mortality are primary factors affecting the size and growth of caribou herds. The WAH population grew to about 450,000 by 1993, primarily because calf survival far exceeded adult mortality until the early 1990s. However, biologists note that the WAH calf survival rate is in decline, and adult deaths per 100 animals are increasing; a trend which may result in herd size reduction if it persists. Neither hunting pressure, disease, nor predation by wolves or bears appear to be a factor in the calf survival or adult mortality trend (Cronin, et al., 1994)(ADF&G, Undated).

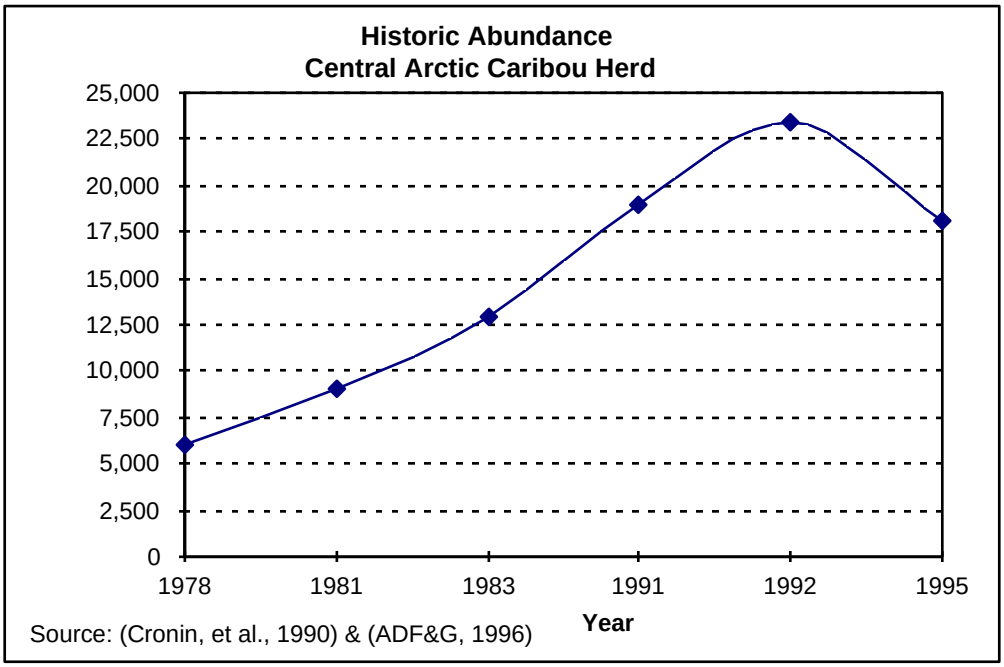
Table 3.5 Historic Population Counts for Caribou Herds.

Western Arctic Herd		Central Arctic Herd		Teshekpuk Caribou Herd		Porcupine Caribou Herd	
Year	No. of Animals	Year	No. of Animals	Year	No. of Animals	Year	No. of Animals
1976	75,000	1978	6,000	1982	4,000	1972	100,000
1978	102,000	1981	9,000	1989	16,700	1977	105,000
1980	138,000	1983	12,900	1993	27,600	1982	125,200
1982	171,700	1991	18,900	1995	26,000	1983	135,300
1986	229,400	1992	23,400			1987	165,000
1988	343,200	1995	18,093			1989	178,000
1991	415,700					1992	163,500
1993	450,000					1994	152,000

Source: Cronin, et al., 1994; ADF&G, Undated; Whitten, 1995; Ott, 1997.

ADF&G's 1995 photo-census revealed fewer caribou in the CAH than in previous census years. The current decline is likely due to a reduction in calf production; a factor biologists correlate with lower nutritional condition of cows at the end of the summer grazing season. While this lack of nutrition may be linked to summer forage availability, other factors may explain the decline in herd size. "After its rapid increase through the 1980s, the CAH may have reached carrying capacity. This could have resulted in population stability. Or, if the population temporarily exceeded carrying capacity, there could have been overgrazing leading to a population decline" (Whitten, 1995:2).

Indications that a herd may overgraze its range and "crash" include smaller calf weight and lower calf production. Awareness of those factors recently prompted ADF&G to thin out the Nelchina caribou herd by increasing the sport hunting harvest, as its current population is approaching what biologists think is its carrying capacity. That herd experienced a dramatic decline in population (70,000 animals to less than 10,000) from 1960 to the early 1970's (ADN, 1996).



b. Moose

Moose are the world's largest members of the deer family and the Alaska moose (Alces alces gigas) is the largest of all the moose. Moose breed annually and both sexes may begin breeding at an age of 16 to 18 months. Calves are born any time from mid-May to early June after a gestation period of about 230 days. Calves begin taking solid food a few days after birth. Newborn calves weigh 28 to 35 pounds and within five months grow to over 300 pounds (ADF&G, 1994).

Rutting occurs during the fall between late September and early October. During this period, moose may aggregate in groups of up to 30 bulls and cows, with movement of individuals between the groups (ADF&G 1986a:139-146).

Moose eat a variety of foods, particularly sedges, equisetum (horsetail), pond weeds, and grasses. During summer, moose feed on vegetation in shallow ponds, forbs, and the leaves of birch, willow, and aspen. Willow stands along rivers and streams are important winter habitat for moose. These riparian areas are especially important during winter when forage is mainly confined along major drainages where shrubs will not be covered by drifting snow. (Sousa, 1992).

Following the snow melt, usually around the beginning of May, moose occasionally disperse across the tundra, but are mainly found in varying elevations in the foothills (See Figure 3.3). Calving also occurs at this time. Moose feed on aquatic vegetation, grasses, sedges, and willow during spring and summer. During winter they feed on deciduous shrubs and crater in the snow for ferns, willow, and foliose lichen.

Moose have a high reproductive potential and can quickly fill a range to capacity if not limited by predation, hunting, and severe weather. Deep crusted snow can lead to malnutrition and subsequent death of hundreds of moose and decrease the survival of the succeeding year's calves. Predation by wolves and bear limits the growth of moose populations in Alaska (ADF&G, 1994).

Moose are found concentrated in winter along portions of the Canning, Kavik, Echooka, Sagavanirktok, and Colville rivers; and Juniper Creek in the southern portion of the sale area ADF&G, 1986 atlas). General distribution occurs all across the North Slope, but this has not always been the case. Fifty years ago there were few moose on the lower Colville River. Breeding populations migrated north and became established. Surveys in the last 26 years show a population increase from 1200 to 1600 moose in that time. Today, the North Slope moose population is experiencing an alarming decline. The adult population has

declined by 50 percent in the last four to five years. There has been little if any calving success in the last three years, and biologists are not sure of the cause. It could be a combination of factors, such as food availability and habitat limitation (population beyond carrying capacity of the habitat), disease, nutrition, predation, toxicity, and mosquito harassment. Food supply varies from year to year, and forage is limited. Moose populations along the Colville and Kavik Rivers are at the northern extent of the species' range, and they are susceptible to bad winters. Increasing populations of wolf and bear are also a likely factor contributing to the decline (Carroll, 1996). A lack of forage could lead to a mineral deficiency which can result in increased predation. Toxicology analysis on the tissue of dead animals collected in the summer of 1996 are being analyzed (O'Hara, 1996).

c. Brown Bears

Formerly, taxonomists listed brown and grizzly bears as separate species. Technically, brown and grizzly bears are classified as the same species, *Ursus arctos*. Generally the term brown bear is used for those found in coastal areas while bears found in the interior areas of Alaska are known as grizzlies (ADF&G, 1994).

Brown bears travel along the major river corridors and feed extensively in riparian areas of the Sale 87 area in the spring and summer and often make their dens along river banks in the fall (See Figure 3.3). Recent investigations of radio-collared bears in the Prudhoe Bay area revealed an unnaturally high and productive population of brown bears in the oil field, most likely due to the supplemental food supply (garbage) available there (Sousa, 1992:6). Bear weights vary depending on the time of year. Bears weigh the least in the spring or early summer. They gain weight rapidly during late summer and fall just prior to denning (ADF&G, 1994).

In the winter when food is unavailable or scarce, brown bears enter dens and hibernate through the winter. During hibernation, their body temperatures, heart rate, and other metabolic rates are reduced, and their need for food and water is eliminated. Bears may spend from 5 to 7-1/2 months in dens. Brown bears enter their dens from mid October through November (Ott, 1997). On the coastal plain, bears den in low hills, dry lake margins, and stream banks to at least within 20 miles of the coast (Ott, 1991). Recent ADF&G grizzly bear research confirms that some of the bears using the oilfields den within a mile of the coast (Ott, 1997). They normally leave their dens in April and early May; adult males emerge first, followed by single females, then sows with young (ADF&G, 1994).

Except for females with offspring and breeding animals, bears are typically solitary creatures and avoid the company of other bears. Exceptions to this occur where food sources are concentrated, such as streams, where bears can catch salmon swimming upstream to spawn (ADF&G, 1994). In the spring, brown bears are commonly found in major river valleys, such as the Colville and Itkillik. They later move to small tributaries and poorly drained areas to feed.

Mating takes place from May through July with the peak of activity in early June. Brown bears generally do not have strong mating ties. Individual bears are rarely seen with a mate for more than a week. Males may mate with more than one female during breeding season. The young are born the following January or February in a winter den. Litter size ranges from one to four cubs, but two is most common. Offspring typically separate from their mothers as two-year olds in May or June. In some areas where food is scarce, females may skip one to three years before producing new litters. Bear populations vary depending on the productivity of the environment. In areas of low productivity, such as on Alaska's North Slope, studies have revealed bear densities as low as one bear per 300 square miles (ADF&G, 1994).

Brown bears consume a wide variety of foods such as berries, grasses, sedges, horsetails, cow parsnips, fish, ground squirrels, and roots of many kinds of plants. In some parts of Alaska, brown bears have been known to prey on newborn moose and caribou. They can also kill healthy adults of these species. Bears are fond of all types of carrion as well as garbage in human dumps. Brown bears have an especially good sense of smell and under the right conditions may be able to detect odors more than a mile distant (ADF&G, 1994). During the summer bears most frequently feed in wet sedge meadows, late snow bank areas, and tussock tundra, concentrating on grasses, sedges, the fruiting and vegetative stems of horsetails. In the fall, bears tend to use the floodplains of large creeks and rivers, dry ridge areas or mountain slopes and feed on roots, berries, and ground squirrels (ADF&G 1986a:103-109).

d. Muskoxen

The muskox (*Ovibos moschatus*) is a stocky, long-haired animal with cloven hooves, a slight shoulder hump and a very short tail. Taxonomists classify muskoxen with the sheep and goats. Muskoxen as a species have changed little since the ice age and are perfectly adapted to live in their harsh arctic environment (ADF&G, 1994).

The original Alaska muskoxen disappeared in the mid- or late 1800s as a result of over-hunting. Muskoxen were re-introduced in the Arctic National Wildlife Refuge (ANWR) in 1969, and are continuing to expand westward into the Sale 87 area west of the Canning River (USDOI 1987:26).

In early April 1992, more than 75 individuals were seen in the Sagavanirktok River drainage north of Sagwon, and 218 were seen within the boundaries of the Sale 87 area (Sousa, 1992:4). Riparian habitat is preferred by muskoxen for virtually their entire annual cycle. River systems that provide diverse low shrub-forb and tall willow communities in proximity to relatively snow-free uplands, hillsides, and plateaus are important to muskoxen (Sousa, 1992). Small numbers of muskoxen occur in the Colville River Delta, in the area of the lower Itkillik River valley, and the headwaters of the Miluveach and Kachemach rivers (Ott, 1997). Known wintering areas occur along riverside bluffs in the southwest corner of the Sale 87 area, in the vicinity of the Sagavanirktok and Ivishak rivers, and along the Kavik and Shaviovik River drainages near the coast. During summer they also utilize the Kadleroshilik drainage (Sousa, 1992).

Muskoxen are relatively sedentary in the winter (October-May), possibly as a strategy for conserving energy. Muskoxen are not migratory, but they may move in response to seasonal changes in snow cover and vegetation. Many bull muskoxen move from mixed sex groups during the summer to bull groups during the winter. Females calve from late April to mid-June, and newborn calves have been observed in ANWR during mid-June. Limited data suggests that the majority of the population calves in the southern portion of the Arctic Coastal Plain on wind-blown, snow-free banks within riparian areas, and in upland sites in the foothills. The rutting season generally occurs in August (Sousa, 1992).

Muskoxen eat a wide variety of plants, including grasses, sedges, forbs, and woody plants. In summer and fall, both sexes may be found along major river drainages where they feed on willows and forbs. In winter and spring, muskoxen groups of 10 to 20 animals may be found in the uplands adjacent to river drainages which afford forage of tussock sedges and have less snow cover (USDOI, 1987:27). Muskoxen are poorly adapted for digging through heavy snow for food, so winter habitat is generally restricted to areas with shallow snow accumulations or areas blown free of snow (ADF&G, 1994).

e. Furbearers

Other species that may be found in the Sale 87 area include arctic and red fox, wolf, and wolverine. Information on the abundance and distribution of these species is limited.

Arctic fox. The arctic fox *(Alopex lagopus)* is found within the proposed Sale 87 area. Both blue and white color phases occur, with the white color phase more common in northern litters. Young of each color phase may occur in the same litter (ADF&G, 1994).

Fully grown arctic foxes weigh from 6 to 10 pounds. They average 43 inches in length including the tail,. which averages 15 inches in length. Arctic foxes may move long distances over sea ice. A fox tagged along the coast of Russia was captured near Wainwright, Alaska a year later (ADF&G, 1994).

Arctic fox pups are born in dens excavated by the adults in sandy, well-drained soils of low mounds and river cut backs. Most dens have southerly exposure. They extend from 6 to 12 feet underground. Enlarged ground squirrel burrows with several entrances are often used as dens (ADF&G, 1994).

Mating occurs in early March and early April. Gestation lasts 52 days. Litters average seven pups but may contain as many as 15 pups. Arctic foxes are monogamous in the wild. Both parents aid in bringing food to the den and in rearing the pups. Pups begin eating meat when about one month old and are fully weaned by 1-1/2 months. They emerge from the den when about three weeks old and begin to hunt and range away from the den at about three months. Arctic foxes attain sexual maturity at nine to ten months, but many die in their first year (ADF&G, 1994).

Arctic foxes are omnivorous. In summer, they feed primarily on small mammals, including lemmings and tundra voles. They sometimes eat berries, eggs, and scavenged remains of other animals. Many foxes venture out onto the sea ice during winter to eat the remains of seals killed by polar bears. In areas where lemmings and voles are the most important summer prey, numbers of foxes often rise and fall with cyclic changes of their prey. Fewer pups are successfully reared to maturity when food is scarce. There is evidence indicating that competition for food among young pups accounts for some of the heavy mortality in this age group (ADF&G, 1994).

Wolf. Wolves *(Canis lupus)* are adaptable and exist in a wide variety of habitats including the arctic tundra along the Beaufort Sea. Wolves are members of the family Canidae. They are highly social animals and usually live in packs averaging 6 to 7 animals (ADF&G, 1994).

Wolves normally breed in February and March, and litters averaging about five pups are born in May or early June. Litters may include from 2 to 10 pups, but most often 4 to 7 pups are born. Most female wolves first breed when 22 months old but usually have fewer pups than older females. Pups are usually born in a den excavated as much as ten feet into well-drained soil, and most adult wolves center their activities around dens while traveling as far as 20 miles away in search of food, which is regularly brought back to the den. Wolf pups are weaned gradually during midsummer. In mid- or late summer, pups are usually moved some distance away from the den and by early winter are capable of traveling and hunting with adult pack members. Wolves are great travelers, and packs often travel 10 to 30 or more miles in a day during winter. Dispersing wolves have been known to move from 100 to 700 miles from their original range (ADF&G, 1994).

In spite of a generally high birth rate, wolves rarely become abundant because mortality is high. In much of Alaska, hunting and trapping are the major sources of mortality, although diseases, malnutrition, accidents, and particularly preying by other wolves act to regulate wolf numbers (ADF&G, 1994).

Wolves are carnivores, with moose and/or caribou as their primary food. During summer, small mammals including voles, lemmings, ground squirrels, snowshoe hares, beaver, and occasionally birds and fish are supplements in the diet. Wolves are opportunistic feeders; very young, old, or diseased animals are preyed upon more heavily than other age classes. Under some circumstances, however, such as when snow is unusually deep, even animals in their prime may be vulnerable to wolves (ADF&G, 1994).

Wolverines. The wolverine, is the largest terrestrial member of the family *Mustelidae*. Its scientific name is *Gulo gulo*, meaning glutton. Wolverines are primarily found in the wilder and more remote areas of Alaska (ADF&G, 1994). They frequent all types of terrain and often utilize rivers as territorial boundaries (USDOI, 1987:339).

Wolverines become sexually mature in their second year. Breeding takes place between May and August. After wolverines mate, the embryo floats in the uterus until late fall or early winter. This type of reproduction is known as delayed implantation, and allows a female wolverine to become pregnant when food supplies are plentiful and when she is in good physical condition. The abundance of food determines whether a pregnancy will be maintained and the number of young that will be born (ADF&G, 1994).

Litters are born between January and April. In Interior and northern Alaska, most young are born in snow caves. These caves usually consist of one or two tunnels that can be up to 60 yards long. Litters usually number between one to three. Baby wolverines, called kits develop rapidly and are weaned at about 8 weeks of age. They leave their mothers at approximately 5 or 6 months to forage for themselves (ADF&G, 1994).

Wolverines travel extensively in search of food. They are opportunistic, eating about anything they can find or kill. They are poor hunters but are well adapted for scavenging. Wolverines can survive for long periods on little food. Their diet varies from season to season depending on food availability. In the winter, wolverines rely primarily on remains of moose and caribou killed by wolves and hunters or animals that have died of natural causes. Throughout the year, wolverines feed on small and medium-sized animals such as voles, squirrels, snowshoe hares, and birds. In the right situations, wolverines can kill moose or caribou, but these occurrences are rare (ADF&G, 1994).

4. Marine Mammals

a. Polar Bears

Polar bears (*Ursus maritimus*) occur only in the northern hemisphere, nearly always in association with sea ice (See Figure 3.4). They are marine mammals and are protected under the Marine Mammal Protection Act. Polar bears and brown bears evolved from a common ancestor and are still closely related, as demonstrated by matings and production of fertile offspring in zoos. Although polar bears may be similar in size to some southern coastal brown bears, they are considerably larger than the brown bears found along the North Slope (Ott, 1997). Adaptations by the polar bear to life on sea ice include a white coat with water repellent guard hairs and dense underfur, short furred snout, short ears, teeth specialized for a carnivorous diet, and hair nearly completely covering the bottom of the feet (ADF&G, 1994).

Polar bears range throughout the coastal areas of the proposed Sale 87. Their dens have been found as far as 32 miles inland (USF&WS, 1987:30). Their distribution is strongly influenced by the local and annual patterns of ice formation, distribution, and thaw. The reforming of the landfast ice sheet in late fall and early winter triggers the return toward land of male polar bears from the permanent pack ice far offshore (MMS, 1993:5). Seasonal movements are influenced primarily by the state of the sea ice and its effect on the distribution of prey. The distribution of their primary food source, seals, is influenced by ice conditions and water depth (Stirling, 1990). Between 1967 and 1992, the population grew about 2 percent per year and may have reached carrying capacity (Amstrup, 1995). The Alaskan population is estimated between 3,000 and 5,000 bears (USDOI, 1995) with at least 140 females seeking dens each fall. Based on radio collar surveys, the Beaufort Sea population dens locally, and is not dependent on reproduction from other known denning areas outside of the region (Amstrup & Gardner, 1994).

Polar bears breed from late March to May (USDOI, 1995) and males travel long distances during this time, searching for females. When a male finds a female, he stays with her a few days, breeds and then goes off in search of another. During early November and December, the pregnant females search out deep snow drifts in which to dig their dens (ADF&G, 1994).

Denning occurs on both land and on sea ice with about half occurring on each. Bears that den on the ice may drift up to 600 miles during the winter. Biologists had earlier thought that pregnant females returned to the same den and thus the specific location of known dens was important for pre-application development planning. However, research indicates that bears do not den in the same place, but are only faithful to the general substrate and geographic area upon which they had previously denned: on ice or on land, and in the eastern or the western Beaufort respectively. The most preferred region for land denning is located east of the proposed Sale 87 area in the northeast corner of Alaska and adjacent to Canada (Amstrup, 1995:291-293)(USDOI, 1995). On the Beaufort coast, polar bears excavate their dens in deep compacted snow drifts adjacent to bluffs, barrier islands, and other elevated areas (Amstrup and DeMaster, 1988). Radio tracking and visual observations have confirmed den locations at Milne Point, Beechy Point, and adjacent to bluffs of the Sagavanirktok River delta (USDOI, 1995:25). The Jones Island group, other barrier islands, and certain coastal areas are important for maternity denning polar bears (Bright, 1992). “Flaxman, Pingok, Cross, Cottle, Thetis and other barrier islands in the Beaufort Sea are known to support maternity dens.” (USDOI, 1995:27). For reasons that continue to elude biologists, the highest density of land denning in Alaska occurs outside of the proposed Sale 87 area along the Beaufort coast of the Arctic National Wildlife Refuge (USDOI, 1995).

A denning female excavates a depression in the snow under a bank, on a slope, or near rough ice. She enlarges the denning chamber as drifting snow accumulates in depth. Pregnant females choose denning areas that have enough topographic relief and the proper slope aspect (south-facing) to catch and hold snow banks under a variety of autumn conditions. In the Beaufort Sea, these conditions appear to be most common on the mainland near the coastline and along rivers where sharp banks accumulate snow. Most dens found on land in Alaska have been less than 6 miles from the coastline, although some occurred up to 36 miles inland (MMS, 1993:8-9).

Figure 3.4 Important Marine Mammal Habitat

Cubs are born during December and January. Normally the female has two cubs. The average female may produce only 1 or 2 litters during her life. Thus, few cubs are produced to replace bears that die. Temperatures in the den are usually much higher than outside, and the cubs could not survive without the shelter of the den and their mother's care. They make short trips to and from the open den for several days as the cubs become acclimated to outside temperatures. They then start traveling on the drifting sea ice (ADF&G, 1994). The mother does not eat while denning; both she and her cubs live off her fat reserves. They stay in their dens all winter, but they can be aroused from their dens by disturbance (MMS, 1993:8-9). Female bears and cubs emerge from dens in late March or April, and may remain near their dens for up to 15 days. Bears and cubs move onto the sea ice during summer. Cubs stay with their mother for about 28 months. Upon separation she usually breeds again. Litters are produced generally every 3 to 4 years (ADF&G 1986a:78).

The main food of polar bears in Alaska is the ice-inhabiting ringed seal. Bears capture seals by waiting for them at breathing holes and at the edge of leads or cracks in the ice. They also stalk seals resting on top of the ice and catch young seals by breaking into pupping chambers on top of the ice in the spring (ADF&G, 1994). Hunting polar bears concentrate near open leads in winter. An important habitat zone in the eastern Beaufort Sea is the seaward edge of the landfast ice, corresponding roughly with the 66 foot isobath (Stirling, 1990). Bears have difficulty catching seals in open water. A polar bear has to catch approximately one seal a week to maintain itself. Bears can eat up to 10 percent of their body weight in 30 minutes. The stomach of a large bear may hold up to 200 pounds of food. Other sources of food include walruses, small whales, birds, seaweed, eggs, berries, lemmings, shrubs, lichens, and grass and occasionally other polar bears. Occasionally polar bears prey on humans (MMS, 1993:5).

Polar bears derive a significant part of their fall and winter diet from whale and walrus carcasses (USDOI, 1995). They also scavenge many things including human garbage, and food caches. They chew on and may eat a variety of manufactured items, including rubber, plastic, rope, canvas, motor oil, snow machine seats, chemicals, and batteries. (MMS, 1993:5).

b. Pinnipeds

The pinniped family, includes ringed seals, spotted seals and walrus. These species are not present in the proposed sale area but are nearby, along the Beaufort Sea coast. Pinna, means a wing or fin; and pedts, a foot. Pinnipeds are protected under the Marine Mammal Protection Act of 1972. Ringed seals are the smallest of the pinnipeds and are the most abundant seal in the Beaufort Sea (ADF&G, 1994).

Ringed seals. Activities of ringed seals (*Phoca hispida*) on the ice vary with the seasons of the year. During the late spring and early summer, ringed seals use the ice as a solid surface on which to haul out and complete their annual molt. They are usually found near cracks, open leads or holes where they have rapid access to water. During winter and spring, most of the breeding adults are found on stable land-fast ice. From March through May, during the spring breeding and pupping season, high densities of adults remain on the land-fast ice while subadults are most numerous in adjacent flow ice zones (LaBelle et al., 1983) (See Figure 3.4).

Females give birth to a single, white-coated pup in snow dens on either landfast or drifting pack ice during March and April. Female seals build lairs in pressure ridges or under snowdrifts for protection from predators and severe weather. There is some evidence that females lacking maternal experience give birth in drifting pack ice and may be more subject to polar bear predation. More experienced females give birth in landfast ice and may have higher reproductive success (ADF&G, 1994).

Ringed seals molt in May and June. During this time they spend long periods hauled out on the ice basking in the sun. It is thought that warmer skin temperatures cause the new hair to grow more quickly. When hauled out on the ice, ringed seals are very wary, raising their heads every 20 seconds or so to look around. They rapidly enter the water when they detect an approaching human or other predator. (ADF&G, 1994)

The amount of time spent on the ice increases as the molt season progresses. In summer, as the nearshore ice melts, most of the adult ringed seals are found along the edge of the pack ice, seaward of the proposed Sale 87 area. Subadults may remain in the ice free areas. Open leads and cracks in the ice are used by ringed seals to surface and breathe. During the fall as freeze-up begins, seals will actively keep breathing holes open (Stirling, 1990).

Ringed seals spend much of the summer and early fall in the water feeding. Ringed seals eat a variety of invertebrates and fish. The particular species eaten depends on availability, depth of water, and distance from shore. In Alaska waters, the important food species are Arctic cod, saffron cod, shrimps, and other crustaceans. Feeding is greatly reduced during the molt (ADF&G, 1994).

Spotted Seal. The spotted seal (*Phoca largha*) is commonly seen in coastal waters of northern Alaska during ice-free seasons. The name is descriptive of its markings, consisting of numerous dark, irregularly shaped spots (sometimes encircled by a faint ring) on a lighter background, usually of a brownish yellow color. Spots are most numerous on the back and upper flanks (ADF&G, 1994).

Spotted seals enter the sale area in July. Spotted seals are known to haul-out on the outer islands of the eastern Colville River Delta. Spotted seals move out of the Beaufort Sea from September to mid October as the shorefast ice reforms (Ott, 1997).

They are annual breeders, and mating occurs in late April to early May. Pupping occurs anytime from early April to the first part of May, although the peak is during the first two weeks of April. Pups are nursed for 3 to 4 weeks, during which time they more than double in weight. Adult females mate about the same time their pups are weaned (ADF&G, 1994).

They eat a varied diet; principal foods are schooling fishes, although the total array of foods is quite varied. There are geographical and seasonal differences in their prey. Along the coast spotted seals feed on herring, capelin, saffron cod, some salmon (especially in lagoons and river mouths) and smelt (ADF&G, 1994).

Bearded Seal. The bearded seal (*Erignathus barbatus*) is the largest seal normally found in the seas adjacent to Alaska. The majority of the bearded seal population in Alaska is in the Bering and Chukchi seas. In the Beaufort Sea the bearded seal is primarily restricted to moving ice during the summer (MMS, 1996a: III-B-7). Bearded seals generally occur in the Beaufort Sea from July through October, and are primarily associated with the pack ice edge (Ott, 1997).

Female seals are able to breed successfully at age 5 or 6. Males become sexually mature at 6 or 7 years. Bearded seals commonly become reproductively active before they attain maximum growth. The incidence of pregnancy in adult females is about 85 percent.. During April, adult male bearded seals begin underwater "singing." The song is a highly characteristic and complex frequency modulated whistle, parts of which are audible to humans. Hunters are sometimes guided to a seal by its whistle (ADF&G, 1994).

Females bear a single pup, usually during late April or early May. The average weight of pups at birth is around 75 pounds and average length is about 52 inches. By the end of a brief nursing period lasting from 12 to 18 days, pups increase their weight almost three times, to around 190 pounds. This gain is due mainly to an increase in thickness of the blubber layer (ADF&G, 1994).

Bearded seals eat a wide variety of invertebrates and some bottom fishes. The main food items are crabs, shrimp, clams, and snails (ADF&G, 1994).

Walrus. Pacific walrus are the largest pinnipeds in arctic and subarctic seas. The majority of the North Pacific walrus population occurs west of Barrow, although a few walrus may move east throughout the Alaskan portion of the Beaufort Sea to Canadian waters during the open water season. They are most commonly found in relatively shallow water areas, close to ice or land. The genus name for the walrus, Odobenus (meaning tooth-walker), refers to one of their most prominent characteristics, their tusks. These tusks, which are elongated upper canine teeth, are present in both males and females. They are huge animals; adult bulls often approach 2 tons in weight, and the females may exceed 1 ton (ADF&G, 1994).

Most females do not begin to breed until 6 or 7 years of age. Mating occurs during January and February, but growth of the fetus does not begin until about mid-June. This delay in fetal growth is thought to occur in all pinnipeds. Walrus calves are born mostly in late April or early May during the spring migration. They weigh 100 to 160 pounds at birth. Calves are dependent upon their mothers for at least 18 months and occasionally for as long as 2-1/2 years (ADF&G, 1994).

Cows will not abandon their calves, and vice versa. The cows make every effort to rescue their offspring. They often carry their dead calves away from the hunters. Walruses, especially young males, will push dead and badly wounded animals (often larger than themselves) off an ice floe, out of the reach of the hunters (ADF&G, 1994).

Walruses feed mainly on bottom dwelling invertebrates. Major food items include several different kinds of clams. The rejected shells can be found on the sea floor alongside the holes and furrows made by feeding animals. Other food items include snails, crabs, shrimps, worms, and occasionally seals. Walruses usually find food by brushing the sea-bottom with their broad, flat muzzles. The tusks are probably not used to any great extent during feeding (ADF&G, 1994).

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